

S20. Ablation and Acceleration of Impurity Pellets Interacted with Fast Ions of NBI in CHS

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A study of the ablation processes of an impurity pellet in helical plasmas is important not only for diagnostic applications but also for further understanding of the ablation physics. We have been carried out impurity pellet injection experiments in NBI plasmas of CHS, and investigated experimentally the ablation process of impurity pellets interacted with fast ions of the NBI. In order to clarify the effect of fast ions for the impurity pellet ablation, two CCD cameras and an eleven optical fiber array were employed to observe the three-dimensional pellet trajectory and the local ablation in the NBI plasma.

The pellets used in this experiment are spheres of hydrocarbon with a diameter of 0.3mm. The pellet velocity is 270m/s. Two CCD camera systems with an interference filter of CI ($\lambda_0 = 538\text{nm}$, FWHM = 2nm) were installed on top (top CCD camera) and outboard side (outside CCD camera) ports near the pellet injector, respectively. The pellet trajectory is simultaneously photographed by these CCD cameras from two directions. Figures 1 (a) and (b) show photographs taken from the top and outside CCD camera in the NBI#1 co-injection plasma ($P_{\text{NBI}}=900\text{kW}$, $\bar{n}_e=1\times 10^{19}\text{m}^{-3}$, $T_e(0)=200\text{eV}$). Thick lines in Fig. 1 (a) indicate the viewing angle of the outside CCD cameras. The drastic deflection of the pellet trajectory is seen in the toroidal and poloidal directions. It is found that the direction of the pellet deflection is consistent with the direction of fast ions of NBI. Signals of the fiber array with an interference filter of CI (ch1~ch11 in Fig. 1(a)) are shown in Fig. 2. The total time evolution of the pellet ablation is observed by a wide-angle optical fiber with an interference filter of CI (ch12 in Fig. 1(a)). It is found that the pellet is strongly ablated at the plasma edge ($\rho=0.7$) and the pellet velocity determined from two CCD cameras and the fiber array measurements is accelerated from 270m/s at the plasma edge to 700m/s near the plasma center (Fig. 3). These results clearly demonstrate that the interaction with fast ions is an essential mechanism for the pellet ablation in the NBI plasma of CHS.

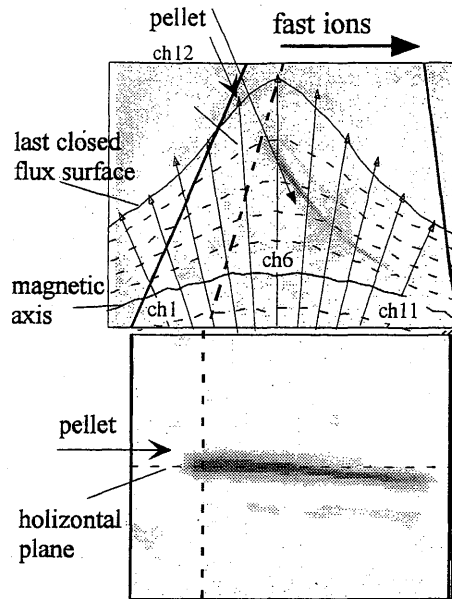


Fig. 1 Photographs of top (a) and outside (b) CCD camera with hydrocarbon pellet injection.

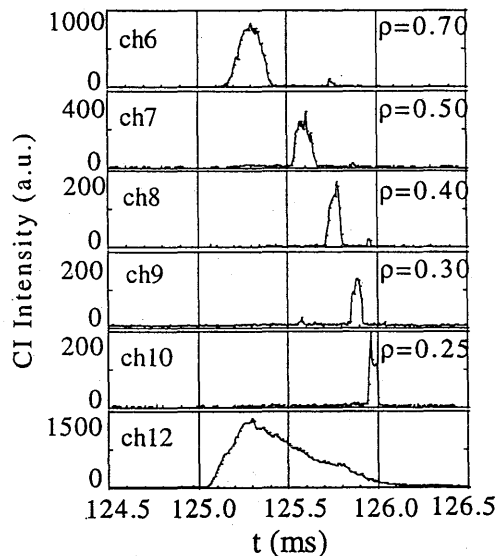


Fig. 2 Signals of optical fiber array (ch6~ch10) and wide-angle optical fiber (ch12)

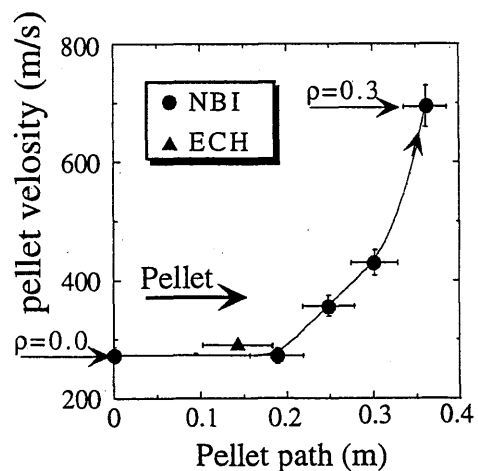


Fig. 3 Spatial distribution of pellet velocity